
Question 87: The increase in light tight oil as a percentage of North American crude slate has resulted in lower FCC feed production, and consequently a reduced FCC feed rate at several refineries. To address these issues, what strategies have you implemented operationally and catalytically? Are you looking at sending new streams to the FCC or increasing the proportion of existing streams such as resid?

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The increase in the quantity of tight oil as a percentage of the North American crude slate has resulted in numerous changes at refiners. Tight oils, like other light sweet crudes, have a much higher ratio of 650°F- to 650°F+ material when compared to conventional crudes. Bakken tight oil has a nearly 2:1 ratio, while typical crudes such as Arabian Light, have ratios near 1:1. A refinery running high percentages of tight oil could become overloaded with light cuts, including reformer feed and isomerization feed, while at the same time short on feed for the fluid catalytic cracking unit (FCCU) and the coker. Some refiners have balanced the use of larger amounts of tight oil with increased use of heavier crudes such as Canadian Syncrude. Other refiners have charged a portion of whole tight oil to the FCC to keep the FCC full.

As refiners consider new feedstocks, testing is a valuable tool to reduce risk. Testing provides understanding of feed properties and potential yield changes. Below are examples of potential tests to use when evaluating a new feedstock.

Testing of feed metals levels is especially important since tight oil derived feeds often contain varying levels of conventional contaminants such as sodium, nickel and vanadium and unconventional contaminants such as iron and calcium. Understanding the expected metals levels of a new feed allows refiners to work with their catalyst vendor to choose catalyst options that mitigate the challenges of these metals. Grace's newest catalyst family, ACHIEVE® catalyst, is designed to address the unique challenges associated with tight oils. ACHIEVE® catalyst formulations are flexible, enabling Grace to design a custom solution for refiners proactively increasing the amount of tight oil in their crude diet.

Feed properties such as API, concarbon and hydrocarbon types can provide insight into the expected crackability of a feed but may not tell the whole story. A fuller understanding of how a feed will crack in a unit can be obtained through testing. Either bench-scale testing (ACE or MAT) or pilot-scale testing (such as Grace's DCR™ circulating pilot plant) can be done. MAT and ACE testing have the advantages that they are easy to set up and require small amounts of material.² However, these units cannot provide the detailed product analysis or feedback on extended operation that pilot scale units can. Larger scale test equipment such as a pilot unit can provide sufficient liquid product for distillation and detailed analysis (such as API gravity and aniline point of LCO produced, viscosity of bottoms, octane engine testing of gasoline, etc.) and can provide information on continuous operation. Additionally, compared to bench scale units, the DCR pilot plant has the advantage that it mimics all the processes present in commercial operation and it can operate at the same hydrocarbon partial pressure as a full-

scale commercial unit. An example of the use of testing to understand the cracking tight oil derived feeds and the effects of operating variables in processing these feeds can be found in Reference 1.

Grace's technical service and R&D teams help refiners assess potential challenges from feedstock shifts before they occur via feed characterization, feed component modeling, and pilot plant studies. Understanding feed impacts earlier provides an opportunity to optimize the operating parameters and catalyst management strategies, enabling a more stable and profitable operation.

References:

1. "Processing Tight Oils in FCC: Issues, Opportunities and Flexible Catalytic Solutions, AM-14-16," 2014 AFPM Annual Meeting, Orlando, FL.

2. "Predicting FCC Unit Performance with Catalyst Testing," PTQ Catalysis 2013.

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